Run 6 – Polarized Protons

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Run6: Preliminary Contours

- Operation with 2 experiments: PHENIX and STAR. Finally we are getting to the RHIC design configuration.

- E=100GeV; N_b->$1.5*10^{11}$, n->111
- Scaling from this run: $L_{av/store}$~$15*10^{30}$
- Beta* configuration: 1 1 10 5 10 10

- Polarization: >50% with AGS cold snake (uncertain yet).

Still Learning

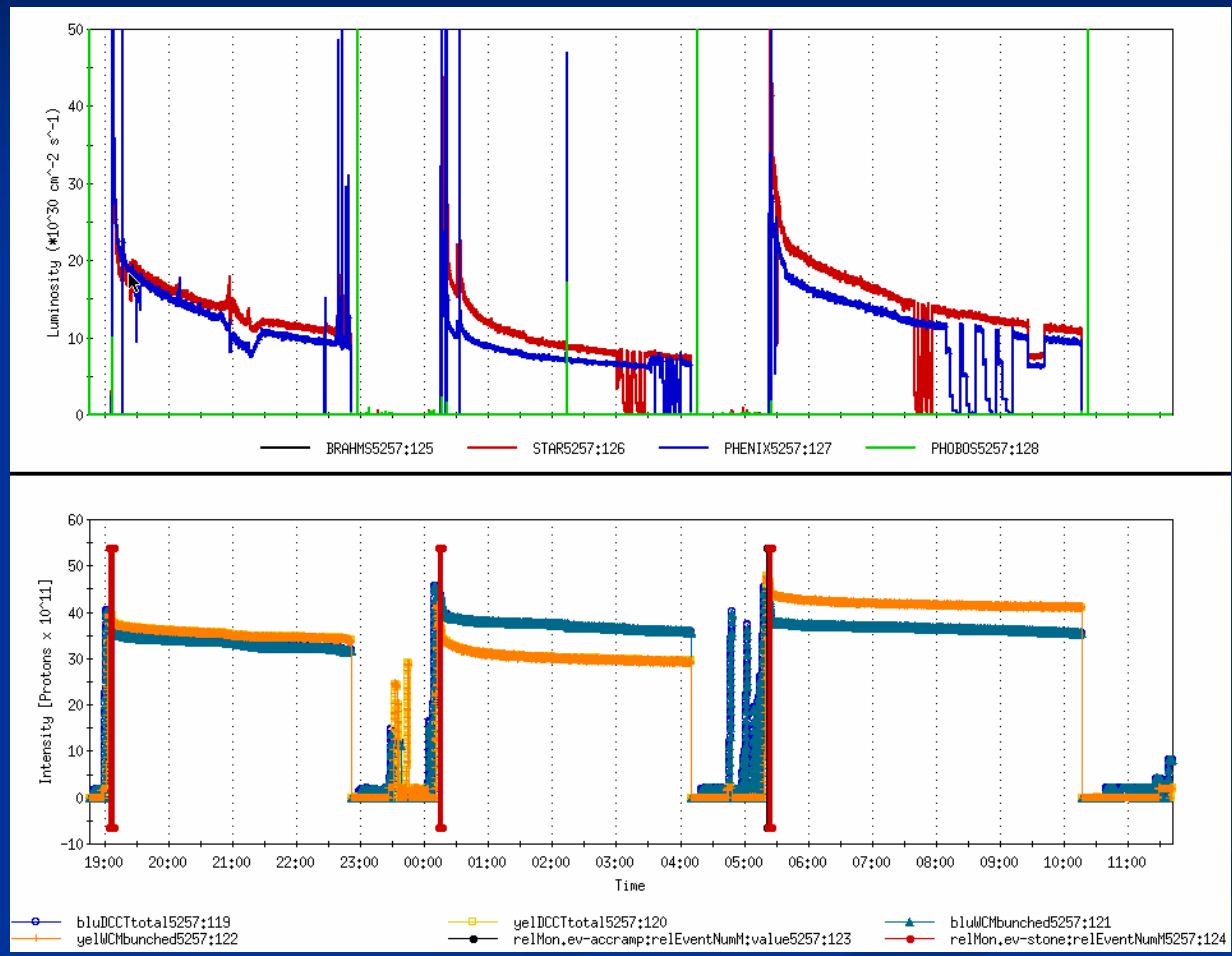
- Run4 is still underway and last days may provide additional important information on what can be achieved in terms of beam parameters and luminosity.

  Especially on what we should plan with AGS cold snake

  as well as what are present vacuum limitations on total beam current.

Run4 Collisions with 2 IPs

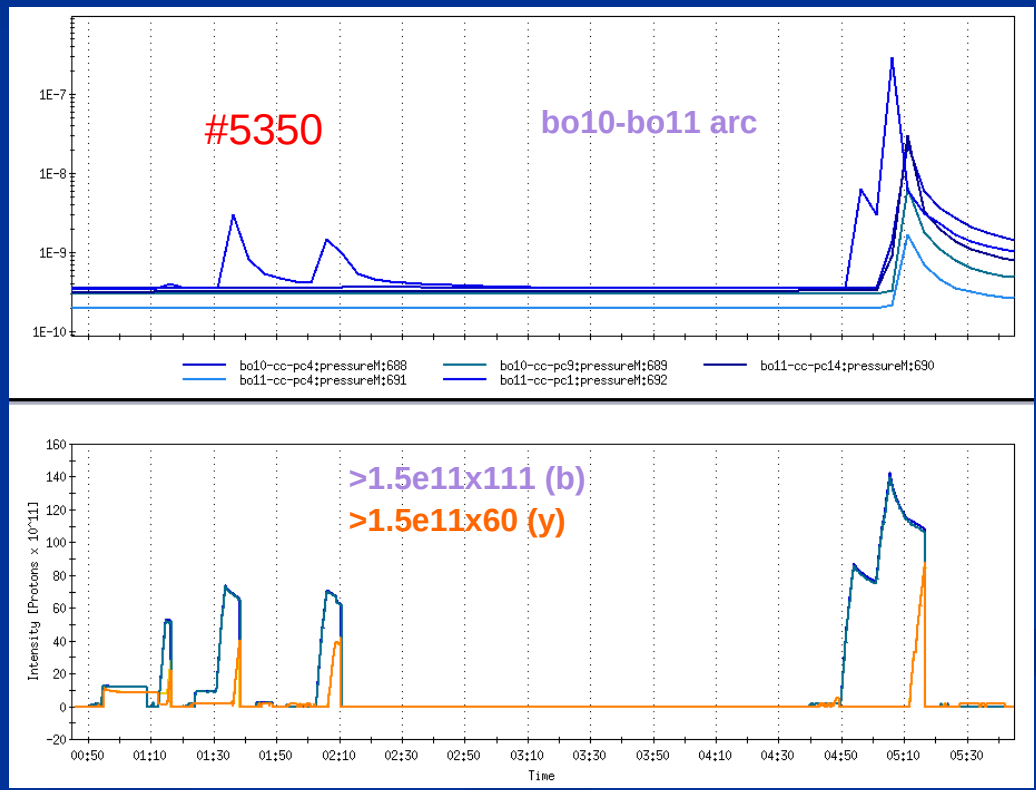
- Store bunch intensities in 1.2-1.5e11 range.
- 28x28 bunches in RHIC
- store luminosity at 1-1.5x$10^{31}$$cm^{-2}s^{-1}$ in STAR and PHENIX



Vacuum Limits

- Run4 studies not quite reached 1.5e11 in 111 bunches in both beams. And, in addition, the effect of cold bore pressure rise was observed.
- Putting more NEG covered pipes in warm regions and careful approach to the cooldown of cold regions (pre-pumping) should improve the vacuum limits.
- Polarimeter vacuum pressure rise.
- Last day Run5 beam studies with high intensity beam should provide the insight on what maximum beam intensity can be presently achieved.

High intensity studies in Run4



Find the Balance

- As was clear from the retreat discussions very important thing (in defining the goals as well as during the operation itself) will be to find the optimal balance between:
  - Accelerator wishes to work closely to the machine performance limit (in order to provide the basis for further luminosity growth) and the experiment needs for higher stability and reproducibility of the machine operation.
  - Effective operation of STAR and PHENIX detectors in the same time.

Experiment Issues

- STAR backgrounds. More than 50% of luminosity is wasted.
  - Additional shielding (like done in PHENIX).
  - Better understanding (Yellow) beam lifetime problem.
  - Increasing STAR beta*.
- PHENIX will greatly profit from decreased bunch length. But operational issues:
  - limited momentum aperture (if using storage cavity);
  - larger pressure rise (if using smaller longitudinal emittance)
- Minimizing time between lumi-on and start of detector data taking.

Solving (in any way) STAR background problem will help here too.

Polarimeter is A Critical Piece

- The ability of CNI polarimeter to maintain reliable work with high total intensity beam (111x1.5e11) will be crucial for the successful operation.
- Considerable effort is required (from Sandro's talk):
  - high quality targets with enough spares + mechanics
  - target controls fully debugged and operational
    interface part of target controls directly to DAQ
  - solve vacuum issues
  - new shaping electronics (for 120 bunches)
  - high intensity studies on the bench
  - new ONLINE software: analysis closer to final
  - separate DAQ PCs for Blue and Yellow polarimeters
- Additional manpower is neccessary to achieve the polarimeter preparation goals.

Ramp Development Lessons

- Ramp development formula: ODTC

  (Orbits, Decoupling, Tunes, Chromaticities).

  Worked very well for 205Gev ramp development.
- Improved rotator ramp development:
  - Delta corrections (orbit, tunes) on the basis of present rotator ramp.
  - Step-by-step rotator field increase.
- Improved tools needed: SQ modulation decoupling, model calculation of tune/coupling due to orbit correction.
- Keeping hopes alive for tune/coupling feedback.

  Needs more development.

Store Lessons

- Working close to machine performance limit requires very delicate control of the machine parameters in order to maintain reliable operation.
- Major factors for store reproducibility:
  - maintaining precisely working point,
  - chromaticity,
  - dispersion in the IRs;
  - finding remedy against the 24h orbit variation.
- More thoughts should be given on asymmetry of momentum and dynamic aperture for Yellow and Blue on the basis of this run data.

Polarization Lessons

- Good polarization transmission (>90%) recipe:
  - Careful snake adjustment at the injection.
  - Y orbit rms ~0.7mm is enough
  - Keep away from 0.7 spin resonance (5^{th} order)
- Bad beam lifetime leads to bad polarization lifetime.
- Ring realignment (?)

Summary

- Run6: due to the reduction of the number of collision points (from 3 to 2) the plan is to increase the total beam current increased by factor 2 (84x1e11 -> 111x1.5e11) with average (per store) luminosity increase to 1.5e31.
- Important task will be to find the optimal balance between operating close to the machine performance limits and providing efficient and reproducible operation for each individual detector.
- CNI polarimeter upgrade is critical for successful operation.
- Many thanks to Mei Bai. Important lessons learnt in Run05 for store reproducibility, ramp development and beam polarization control will provide solid basis for (hopefully) reliable operation in Run6.